Point Transect Protocol for *Monitoring Colorado's Birds*

I. Project overview

Rocky Mountain Bird Observatory (RMBO) in cooperation with Colorado Division of Wildlife, U.S. Forest Service, Bureau of Land Management, and other agencies, has developed a program to monitor bird populations in Colorado that utilizes point counts along transects (i.e., point transects) as the primary sampling technique. The point-transect portion of this program has been designed to be statistically rigorous and biologically sound, and should produce data for analyses of population trends of approximately 106 bird species that breed in the state. This document delineates the design and operation of our point transect program. It is intended to instruct our field workers on how to establish and run the transects *and* for others to follow when establishing monitoring projects of their own, so that design and methods are comparable.

II. Transect design and overview

In this program, the transects, not the individual points, are the sampling units. Thus, each point transect provides a robust parameter for analyzing population trends that is based on the average across many sub-samples taken from a particular site. Because point counts provide ***samples*** of the local bird community, ***they are not intended to provide a census***. It is assumed that some of the birds present within the area of a point count will not be detected--some will not vocalize or otherwise make their presence known for the duration of the point count. However, some species simply occur in such low density across the landscape that they are not well sampled by point counts. In order to increase sample size for these low-density species, we have added a line-transect facet to the point-transect design. Thus, the inter-point intervals are considered legs of a long line transect (between the first and last points) on which we record individuals only from a short list of low-density target species (Fig. 1).

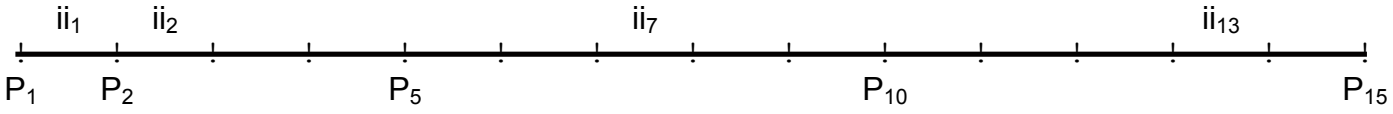

Fig.1. Depiction of point-count transect showing points (P_n) and inter-point intervals (ii_n). Point counts are conducted at points (all species are recorded). Only low-density target species are recorded along inter-point intervals. The inter-point interval distances are the same within habitats and across habitats.

Thirty 15-point point transects are established within each habitat. The access point for each transect is determined randomly, but should fall *on a road* running through the habitat or within one mile of the habitat.

After much consideration about transect placement in relation to roads, we decided to avoid biasing transects toward roads, but also to avoid biasing them against roads (they *are* a part of the landscape). Thus, our working assumptions for establishing transects along roads, but then running them irrespective of roads, are:

1) We know that Colorado is mostly unroaded, therefore, transects should sample primarily unroaded areas;
2) We know that frequency of roads is variable by habitat;
3) We know that species have different size territories/home ranges and varying responses to roads; and
4) There are no studies demonstrating strong or consistent road effects (see Rotenberry and Knick 1995, Hutto *et al*. 1995, Keller and Fuller 1995 which show that, for most species, there are no differences between results of counts on roads and of counts away from roads).

Once an access point is chosen, the transect's first point is placed 0-400 m (determined randomly) from the access point, within the target habitat. Point transects consist of 15 points each. From point 1, transects continue along a pre-selected random bearing for all successive points until point 15 is reached or the transect meets some obstacle or a major habitat edge, either of which forces a turn in the direction of the transect. All transects have inter-point intervals of 250 meters.

Materials

Before heading out into the field, each technician should be sure s/he has the following (unless otherwise indicated below, RMBO will supply all materials):

A. A timepiece with a countdown timer and a chime (*you must provide this*);
B. Binocular (*you must provide this);*
C. A declination-adjustable compass with sighting capability (i.e., a mirror);
D. A clipboard;
E. At least two writing utensils - in case you lose one (pencil or indelible ink pen) (*3 pencils will be provided by RMBO at the start of the field season; if you lose these you must provide additional writing utensils*);
F. GPS unit;
G. Rangefinder;
H. Extra batteries;
I. Data forms sufficient for the transect planned that morning;
J. A master list of four-letter codes taped to the clipboard for easy access;
K. A master list of weather and habitat codes, also taped to the clipboard; and
L. A random numbers table, if establishing a new transect.

IV. Setting up new sites

Most transects have already been established. For these, all you have to do is follow the directions on your transect description sheet and use your GPS unit to locate each point. However, some will establish new transects. For each new transect, select an access point on the site map that will provide the easiest access to that site. As a general rule, the access point should be located within or adjacent to the site, at a recognizable location that will require the least amount of driving to get to, but that will also provide a safe place off the road to park a vehicle. *Avoid using 4-wheel drive roads*

whenever possible, as that will reduce the need for 4-wheel drive vehicles in the future. A good place for an access point is at the junction of 2 roads, which is usually well marked. While en route to the access point, record clear directions using mileages

between junctions or turns whenever possible, to ensure that sites can be found with as little effort as possible by future observers. As a rule of thumb, provide directions that are clear enough so that your grandmother could find her way to the access point! *If your grandmother would get lost following your directions, they are not clear enough!* Record the UTM coordinates at the access point using your GPS. For more details on establishing access points, see Appendix A.

If the access point lies on a road that runs through or adjacent to the target habitat, follow the protocol in A below; if not, then follow the protocol in B below. For transects in linear habitats (e.g., Riparian) use the protocol in C below.

A. *Establishment of transects from roads that run* ***through*** *or* ***adjacent to*** *the target habitat*--From the access point, use the GPS unit to measure the pre-determined random distance (0-400m; using random numbers table) along a pre-selected random bearing (see D, below) heading into the stand to get to point #1. In many stands, the orientation and shape of the stand will force you to select a bearing from a limited array of possibilities. In cases where the random bearing will quickly (in the first 2-3 points) and permanently take the transect out of the target habitat, then you should select another bearing. The first point count and the beginning of the transect is reached at the end of the random distance.

From the first point, continue along the pre-selected, randomly determined bearing to all succeeding points. In cases where you run into the end of the target habitat, a private property boundary, or some other obstruction (e.g., cliff), you should backtrack to the last count station and randomly select (flip a coin) whether to turn right or left (if both alternatives are possible), then continue the transect *perpendicular to the original bearing* in the direction selected by the coin toss. If the shape of the stand does not accommodate at least one point in a direction perpendicular to the original bearing, randomly select a bearing on which to continue the transect from the range of possible bearings. Should you need to make further direction choices at habitat (or property) edges, repeat the above described process, but beware of boxing yourself in.

B. Establishment of transects from roads that do NOT run through the target habitat— Some stands are not directly accessible by maintained roads. In these cases, you will need to establish an access point along the road and then walk a bearing (or the most easily repeatable route) from the access point toward the target habitat, that will reach it in the shortest possible distance (record this information under “transect description” on the field form. (If you cannot see the habitat from the access point, check with the site map to see where the target habitat is, then walk toward the habitat.) Upon reaching the target habitat, you are at the first point. From the first point, run the transect along the pre-determined random bearing that will take you through the stand (see *selecting random bearings for transects*, below). Should you hit a habitat (or other) edge after initiating a transect, use the protocol for such a situation found in IV.A. above.

C. *Establishment of transects in linear habitats*--Transects in linear habitats are established in much the same manner as with other habitats, with a few exceptions. Select an access point that will ensure that all 15 points will fit within the site beginning from that access point (remember, 15 count stations, plus the random pre-transect distance requires about 4 km, or 2.4 linear miles of habitat). In other words, if your

riparian site is only 2.5 miles long, don't start your transect in the middle! Transects that survey linear habitats (*e.g*. riparian habitats, some spruce and aspen sites) should not follow a pre-determined bearing, but should instead *follow the habitat and* ***attempt to stay in the middle of that habitat***. Whenever possible, ***avoid doing point counts along the edge of a linear habitat***, so that you maintain an equal chance of observing birds of that habitat at any distance in all directions. Doing counts from the edge of a habitat results in increased distance estimates for your target birds in that habitat, while decreasing distance measurements for your non-target birds from adjacent habitats, and thus leads to inaccurate density estimates for species. If you must use a road or trail to get between points in a linear habitat, once your reach 250 m, go into the middle of the habitat to establish the count station (as long as it doesn't involve trespassing). One should also be cautious of maintaining adequate inter-point distances when laying out transects in linear habitats, as a meandering linear habitat will often require that more than 250 meters are walked by the observer in order to ensure that the 250 m interval (*as the crow flies*) is maintained between points. **At all sites, it is essential to use the "way-points" feature on the GPS unit to ensure the proper inter-point distance.**

D. *Selecting random bearings for transects*--A random numbers table will be provided at the start of the field season. Field workers that establish transects **must** have one on hand. Before selecting a random bearing for a site, you must first determine the range of possible bearings you can select from for that site, based on the location of your access point. This is best accomplished using the site map and a compass. Set your compass to 0º (but your compass should be declined) and lay it on the map so that the center of your compass lies *exactly* on top of the access point you have selected and so that North (0º) points toward the top of the page. Using a pencil, lightly draw marks for the two bearings that will provide the extremes in terms of potential bearings that will take you through the stand. Now, to randomly select a bearing from the table, look at the first three-digit number on the table that has not yet been used. If the number falls within the range of possible bearings for your specific site, that is your bearing. If not, continue down the list until you find the first number that does fall within your potential range of bearings. Once you've used a number from the table, *cross it off* and *do not use it again*. For your next random bearing, start at the top of the numbers table with the next available *unused* number and repeat.

E. *Measuring inter-point distances*—We will generally rely upon the "go to nearest way-point" feature in the GPS units to ensure that points are located 250 m apart. When approaching to within 50 m of the 250-m interval (using pacing as a guide), turn on the GPS unit and allow it some time to give you an accurate reading. Clouds, dense forest canopy, and steep canyon walls can all make it more difficult to get an accurate reading. When the GPS tells you that you are 250 m from the previous point, you are at the next count station. If, when you stop at 250 m, the location is unsuitable for detecting the

birds (e.g., where your vision or hearing is significantly impaired), continue walking as short a distance as possible in order to establish the point where you can effectively hear/see the birds in the area. Then take the GPS location, record the UTM, and make note of the extra distance added to the inter-point distance. Use of the GPS units will be covered during the training session. However, it is still useful to be able to reasonably estimate distances by pacing when hiking between points, although pacing should only be used as a guide, and should not alone determine where you establish the points.

F. *Determining your pace for pacing distances*--To determine the length of your pace, measure and mark a 100-m inter-point distance (preferably over some uneven terrain) and then walk that distance and count the number of steps it takes to cover it. You should walk at your normal speed, without trying to take steps larger than you normally do; your pace needs to be consistent and repeatable. Repeat this process in the opposite direction. If your two tries were very different, then try again (and again) until the two attempts are similar (within two paces of each other). Once you obtain two similar values, take the average of those values. Then determine the number of paces you need to cover the 250 m inter-point distance by multiplying the number of paces you needed to cover the 100 m by 2.5 (example: If you did the 100 meters in 150 paces, then 2.5 x 150 paces = 375 paces for 250 meters). This will be done during the training session.

V. Conducting the point transects

Seasonal Timing--Point transect counts should be performed after all migratory species have returned to the area and as early in the season as possible, but beware of performing them too early and potentially counting a lot of transient migrants, or missing some of the breeders that have not yet arrived. Also, transects within a given habitat should all be performed in as short a period as possible--within three weeks; less, if possible. Obviously, counts performed in grasslands in late May are not comparable to counts performed in the same habitat in early July, as most locally breeding species have completed nesting and are much less vocal in July than they were in May. By limiting the period in which transects in given habitats are performed, we reduce the amount of seasonal variability in singing rates, and hence detections, that we capture in our data. A table of appropriate "windows" of time during which point transects should be completed in each habitat will be provided at the start of the field season.

There are **two aspects** to the collection of bird data along point transects: the **5-minute point counts**, and the **continuous line-transect count of low-density target species** observed *between the first and last points*.

A. Point Counts—Upon reaching a point*, fill out ALL the UTM and habitat data on page 1 of the field form* ***first*** (including directions to point). ***Do NOT begin counting until after this is done.*** Doing this *first* is important for two reasons: it will ensure that you do not forget to write it down, as is possible if you wait until after the count is done, and it will allow the local birds to "settle down" somewhat after the disturbance you created when approaching the point. If the GPS unit is

taking a long time to get a stable reading, record all other site information and begin the count, *but leave the GPS unit on and don't forget to take a reading before you leave the station!* However, you only need to record UTM locations for new sites; for established sites, simply use the GPS to get to the exact location of the point. After recording or verifying the UTM location, *turn the GPS unit off to conserve batteries*. Turn it on again as you approach the next point.

1. **Habitat data**- Pay particular attention to filling in the squares in the habitat block of the data form for *each of the 15 points per transect* ***while at each point***. The habitat data will be used to relate bird use with vegetative features of the habitat and will have real applications for managing habitats

for birds, so please be thoughtful in providing these data. At each point, describe the habitat around the point-count station by selecting the best and next-best habitat classifications that describe the landscape around the point. When more than two habitats make up significant components of the landscape around you, select the one habitat that occupies the most area around you as "best habitat" and for "next best habitat" select the habitat that is contributing the most birds to the count (other than the "best habitat"). For each habitat selected, you should also assess the seral (or structural) stage and canopy closure of those habitats (see Appendix D for detailed descriptions of habitat classifications and seral stages). Next, select the primary understory vegetation category that best reflects the dominant woody understory vegetation *within a 50 m radius around the count station*, **and** estimate the percent of that 50 m radius occupied by that vegetation type. Then, select the secondary understory vegetation category that best reflects the second-most dominant woody understory vegetation *within a 50 m radius around the count station*, **and** estimate the percent of that 50-m radius occupied by that vegetation type. See Appendix A for a complete list of habitat and understory categories and classification codes, as well as for more details on how to assess habitat characteristics.

2. **Bird data**- After the general habitat data are recorded at the point count station, activate your timepiece and begin counting and recording the birds you see and/or hear. **The count duration is 5 minutes**. *It is important to use a timepiece that has a count-down timer and a chime that rings at the end of the period*. This avoids counting birds beyond the duration of the count and eliminates having to look at the timepiece to see how much time remains in the count, and thus potentially miss birds. All birds detected during the 5-minute count period should be recorded using the ***correct 4-letter codes*** (See Appendix C for bird species codes; most are obvious, but please commit to memory those codes that are unusual and do not follow the general rules). Birds flushed from the count station upon arrival should also be recorded (and their distance *from the point* measured), as it is assumed that these birds would have remained at their original locations were it not for the disturbance created by the observer.

In short, for each bird you record on a point transect, you should also record:

1) the **radial distance** from you to the bird;
2) **how** the bird was detected;
3) the **sex** of the bird (if known); and
4) if it is a low-density target species, the **bearing** from you to the bird.

a. *Measuring Distances:* Using the rangefinder, measure (or estimate when necessary, using the rangefinder as a gauge) the distance from the point to *each and every individual bird detected during the count* and record the distance on the data sheet under "Radial Distance". **Every bird recorded on point transects must have a radial distance measurement associated with it!!! This is imperative!** Because this monitoring program relies on distance-sampling techniques and analyses, *birds without associated distances are essentially useless and*

cannot be analyzed with the larger datasets! The premises behind distance sampling will be further explained during the training session. But please, *please, PLEASE* do not forget to measure and record radial distances for EVERY bird recorded on point transects!

All distances should be ***measured*** using the binocular rangefinder whenever possible. If you cannot get a direct line of sight to the location of a bird, use the rangefinder to measure to a point close to that bird, and then add or subtract the estimated distance between that point and the bird to obtain the best possible distance estimate from the point to the bird. Distance sampling relies upon the assumption that all distances are measured to within 10% of true accuracy, so *use your rangefinders as much as possible!*

Always measure distances to where the bird was first *detected*, not necessarily to where it was first identified. *For low-density target species observed at point counts, measure the radial distance to each bird* (or estimate when necessary) ***AND record the bearing from the point to the bird*** (see Transect counts, below). For birds that are vocalizing but not seen, try to pin-point their locations to a specific tree/bush, then measure the distance to that tree. If you are unable to pin-point its location to a specific tree/bush, then estimate the distance, but ***do not round distances*** *to the nearest 5- or 10-m interval*. Rounding distances causes heaping at popular values and makes analysis more problematic! If you see/hear a bird that is beyond the range of the rangefinder, measure to the furthest object in the direction of the bird that the rangefinder can measure to, and estimate the distance beyond that object to the bird. Add your estimate plus the measured distance and record the sum as the total distance.

b. *Other Bird-related Data*: In the "How" column, record ***how each bird was detected***, i.e., whether the bird was detected by ear (C=calling, S=singing, D=drumming, O=other, e.g. wing beats) or by sight (V=visual). In the "Sex" column, record the sex of the bird, *if known* (F=female, M=male,

U=unknown). Assume that a singing bird is a male unless it is an individual of a species of tanager or of the Cardinalidae. However, if an individual bird is singing emphatically and repeatedly, then record it as a male, regardless of species. Females of many species will sing, although generally their songs are less emphatic and extensive. Unseen birds (or monomorphic birds that are seen) giving only non-sex-specific calls should not be sexed.

Example: On point 1 of a Ponderosa Pine transect, you detect six birds. You see a male HAWO, hear a drumming WISA, a calling WBNU, a continuously singing WETA, a singing CHSP, and you see a brown-plumaged CAFI. You should make estimates of radial distances for all six individuals and take bearings for the two woodpeckers and the CAFI. In order, the "How" column should be filled in with V, D, C, S, S, and V. The "Sex" column should be filled in: M, U, U, M, M, and U, respectively (male CAFI

require two years to achieve adult plumage, thus a brown-plumaged bird cannot be sexed in the field).

c. *Flyovers:* For flyovers, enter the species code and an "F" in the "How" column and draw a short line through the distance column – i.e. you do not need to estimate distance for flyovers. *For individuals of species that habitually hunt on the wing (e.g., raptors, swifts, swallows), record those individuals that appear to be foraging as on the point, **NOT** as flyovers*. Additionally, individuals that are first detected in flight, but that are simply flying from perch to perch within the habitat should NOT be recorded as flyovers. Provide distance estimates to those flying individuals that you record as using the habitat around the point. Thus, estimate distance to the point at which you first saw the bird(s) and record the best how-detected variable.

e. *Other Survey Tips:* While conducting counts, be sure to look and listen in all directions, including up. It is best to slowly rotate in place while you are counting; making three complete turns in the five minutes is probably adequate. **Don't forget to look up!** It is very important to stay in one place while counting - *it is called a point count for a reason*. It is acceptable to take a step or two away from the point in order to identify a bird that you have detected from a point, but cannot identify from the point, but ***ALWAYS*** return ASAP to the point. Do NOT chase birds during the count. After the five minutes are up, you may chase down a bird that you couldn't identify on the point in order to get an identification for the point, but do not leave the point during the five minutes and do NOT record birds on the point count that were found only while you were chasing another bird. ***Remember: Consistency of methods and coverage is the key to useful data!*** Be aware of what is going on around you and realize that you will hear individual birds on multiple points. When at a point, **DO NOT** count an individual bird that you saw and/or heard on a previous point.

Example 2: On a Grassland point, you see an adult male NOHA quartering low over the habitat. You record it for that point, finish the point, and walk to the next point. After writing down the point information, you start the count. You look in the direction of the previous point and see two NOHAs, one of which is an adult male. For the second point, you should record only one NOHA, as you probably recorded the adult male on the previous point.

Example 3: At the same point as above, you hear two WEMEs singing, each bird roughly perpendicular to the transect line on opposite sides of the transect from each other. When you start the next point count, you hear three WEMEs, two from back by the previous point on opposite sides of the transect and one in the opposite direction toward the third point. You would record only one WEME for the second point, as you already recorded two WEME from that area on the first point.

2. **Transect counts** (i.e., between points)--Conduct a continuous transect count *between the first and last points* of the transect and record all observations of

low-density target species (see your clipboard for a complete list) and other rare or unusual bird species. ***For each low-density target species detected, you should measure*** *(or estimate)* ***radial distance <u>and take a bearing</u> from your position on the transect to the target bird****.* Use your compass to sight in the direction of the bird and record the bearing in the appropriate space on the field form. You should record bearings for all low-density target species detected on transects, regardless of whether they are recorded on points, or while in between points. Do not forget to take a bearing for low-density targets detected during point counts, as the time spent at point counts is part of the *continuous* line transect. Fill in the "How" and "Sex" columns for each low-density target just as you would for any other bird. For all low-density target species observed between points, record "99" as the point number.

While walking between points, move at a constant speed and concentrate on listening and looking for target species. Keep your eyes and ears open and spend as little time as possible looking down. However, do watch where you are going enough to follow the correct compass bearing and avoid hazards. If you detect target species as true flyovers (i.e., they are not using the habitat), enter the species code and "F" in the how detected column, but do not estimate distance to the bird(s) unless they land. *Individual birds that are first encountered on points should* ***NOT*** *be recorded again*. ***However, if you record a target bird in between points, and then while conducting your next point count you hear/see <u>that same individual</u> bird again, remove it from the "99" category, add it to your point count, and treat it as though it was first detected during that point count.***

<u>A note on declinations:</u> If you do not have access to topo maps with the correct declination for the transect, then use the default of 11□E. Whatever you do, document it in the notes section of the data form so that future observers can duplicate your efforts. However, your GPS unit should be set on True North,

such that all readings from that are true values and will not require declining.

VII. Potential problems when conducting point counts

A. *Window species*--This is "listening through" (not detecting) a particular common species because you are habituated to it (Mourning Dove is a common window species).

B. *Looking/listening everywhere*--Be sure to look up regularly, particularly in taller forest types and, particularly if you are wearing a hat. Be sure to look AND listen in all directions (try to look and listen in all directions about equally).

C. *Stand at points*--**Do not sit or kneel**, as this can reduce the number of individuals recorded, by decreasing visibility, audibility and dexterity. If you are tired, take a short break after the point count.

D. *Recording data*—Do not use a second person as a scribe; this can enable the observer to record more birds (or fewer, if the scribe detracts from the job at hand or creates more disturbance), therefore those points are not comparable to points that were conducted by one person.

E. *NO pishing*--Do not attract birds to you. Pishing is permissible after the count in order to attempt to identify an individual that was not identifiable on the count, but *do not add other individuals after the count that were not first detected during the count period.*

F. *Airplane (and other) noise*--If audibility of birds is reduced by mechanical noise, interrupt the count (i.e., stop your timer), and restart when the noise abates so that the total time still equals a five-minute count.

G. *Guessing*--Never guess on the identity of a bird. Instead, use an unknown code (*e.g*. unidentified sparrow - UNSP) for those individuals about which you're not sure. *However, recording a lot of unidentified birds is an indication that you need to learn/practice more before performing point counts*.

H. *Practice*--**Practice in habitat before conducting actual counts**. Be familiar with the songs and calls of *all* species found in a habitat before conducting point transects in that habitat. Use the habitat-specific bird lists along with CDs or tapes to practice before (and during) the field season.

VIII. Literature Cited

Ralph, C.J., J.R. Sauer, and S. Droege, eds. 1995. Monitoring Bird Populations by Point Counts. Gen. Tech. Rep. PSW-GTR-149. Albany, CA: Pacific Southwest Research Station, Forest Service, USDA. 187 pp.

Hutto, R.L., S.J. Hejl, J.F. Kelly, and S.M. Pletschet. 1995. A comparison of bird detection rates derived from on-road vs. off-road point counts in northern Montana. Pp 103-110.

Keller, C.M.E. and M.R. Fuller. 1995. Comparison of birds detected from roadside and off-road point counts in the Shenandoah National Park. Pp 103-110.

Ralph, C.J., S. Droege, and J.R. Sauer. 1995. Managing and monitoring birds using point counts: Standards and applications. Pp 161-168.

Rotenberry, J.T. and S.T. Knick. 1995. Evaluation of bias in roadside point count

surveys of passerines in shrubsteppe and grassland habitats in southwestern Idaho. Pp 111-116.

Appendix A, part 3. Explanation of field form and data codes.

SITE DATA (at top of page 1)

***Transect #*:** Enter the **four-character** transect number using the ***correct* habitat codes** as described below (e.g., MS01, for Montane Shrubland #01, **not** MS1);

Observer: Enter your first two initials *and your full last name*

Map coord.: Enter the map coordinates for the transect Access Point, using either or both the *DeLorme* or *Roads of Colorado* atlases

Directions to access point (VERY IMPORTANT!)*: *Provide explicit directions to the access point from some nearby town, major intersection, or geographical feature readily found on a *DeLorme* or *Roads of Colorado* atlas. Provide mileages from intersections or other landmarks using your odometer. **If the observer last year did not provide adequate directions to your site, *please provide better directions this year*.** For new sites (*or for those lacking Access Point UTM coordinates*), take GPS readings and record **UTM coordinates** (and stored GPS waypoint#) for each access point. Also, **be explicit in your description about the *exact location* of the access point** (e.g., "the right post of the green metal gate" or "the NE corner of the bridge").

Example: MS02: From jct. of Highway 61, head East on Happy Canyon Rd for 8.4 miles to jct. with 420 Rd. Head South on 420 Rd through narrow canyon for 2.1 miles, cross over wooden bridge and park in 1st pullout on right. Access point is the tall wooden post at the SW corner of the bridge.

Transect description*:** Provide the **distance** and **bearing** *from the access point **to** the first point* (do not provide bearing from first point back to the access point). Then, provide *between-point accounts*, describing the topography, habitat, landmarks and/or other features that you pass prior to arriving at the next count station, with sufficient detail so that future observers can follow the same route that you are establishing. ***It is especially important that you record any turns, changes in bearings, or other deviations that you make from the original transect bearing. Also, provide a brief description of the area surrounding the count station, or any noticeable features of the landscape at each point, again so future observers will know when they have reached the area of the point-count station. *As this is a long-term monitoring program, the importance of providing detailed directions/descriptions for each transect cannot be overstated!* GPS locations alone are not sufficiently reliable as the accuracy of GPS locations can be changed significantly by the U.S. Government (as happened after Sept. 11). Please provide the transect description information in the general format and detail as described in the following example.

Example: Pt#6: From pt 5, turn to 356E and head down steep drainage. Stay on bearing, passing ~45 m to the right of drainage bottom, where drainage meets larger valley. Continue through small stand of aspen; cross dirt 2-track at ~175 m; cross small creek at ~225 m. After creek, head up small hill with tall spruce trees on top. Point is on top of this hill, ~3 m south of largest-diameter spruce.

TRANSECT DATA (middle of page 1)

Date: Enter the date in the format: MM-DD-YY
Time: Enter start and stop times for entire transect (not individual points) using 24-hour clock

Sky (start and end)**:** Enter one-digit codes at beginning and end of transect (not at points)
0=0-15% cloud cover *1=16-50% cloud cover* *2=51-75% cloud cover*
% cloud cover *4=fog* *6=drizzle*
You shouldn't conduct counts in any other conditions!

Wind (start and end)**:** Enter one-digit codes at beginning and end of transect
0=Less than 1 mph; smoke rises vertically
1=1-3 mph; smoke drift shows wind direction
2=4-7 mph; leaves rustle, wind is felt on face
3=8-12 mph; leaves, small twigs in constant motion; light flag extended
4=13-18 mph; raises dust, leaves, loose paper; small branches in motion
YOU SHOULDN'T CONDUCT COUNTS IN ANY OTHER CONDITIONS!

Temperature (start and end)**:** Use EF (no thermometer?, estimate to nearest 5E)

Transect notes: Enter information relevant to the site, good camp sites, cool scenery, or other tidbits that either don't really fit in other places or that future surveyors might find interesting.

UTM data: *Enter the UTM coordinates* (**using the NAD27 CONUS datum** in navigation setup) *for each point-count station associated with a **new** site* (*for established sites, only take a GPS reading if you are moving the count station; in these cases, provide new directions to the count station as well*). Be sure that the GPS reading is essentially stable before recording the UTM location. **Record all *new* UTM coordinates in the appropriate spaces provided on the field form and save all *new* UTM coordinates in the GPS units using the "Mark Waypoint" feature**. *Record the stored waypoint number, as indicated on the GPS unit, under "WP#", next to each UTM coordinate, respectively*. The stored UTM coordinates can then be uploaded to a PC, and thus you won't have to enter UTM coordinates as part of your data entry duties. However, each unit can only store 500 waypoints, so you will need to delete some of the established sites from the GPS unit (*after* completing the transect!) before you input additional locations. Whatever the situation, *make sure that **all** new UTMs get recorded on the field forms as well as in the GPS units!*

HABITAT DATA (bottom of page 1)

Within 100m of road (Y/N): Enter "Y" for yes and "N" for no for **EACH** point based on your best knowledge of the site. For our purposes, a "road" must be substantial enough so that it either causes a significant disruption of the understory vegetation OR a break in the canopy. For example, a grassy 2-track running through an open meadow should not be considered a road, whereas a gravel or dirt road that forms a 3 to 4-m wide break in the grass cover would be considered a road. Similarly, an old, pine needle-covered logging track in an open forest situation should not be considered a road, whereas a logging road that causes a clear and wide break in the woody understory vegetation, or in the forest canopy, should be considered a road. This topic will be covered more thoroughly during the training session.

On private land (Y/N): Enter "Y" for yes and "N" for no for **EACH** point. Be sure that you have

permission to conduct counts that are on private land!

Bearing to point: Enter the true bearing (do not use magnetic bearings) you followed from the last point (or access point) to arrive at the current point.
Best habitat classification: Enter the two-letter code of the habitat that BEST describes the habitat surrounding the point count station. Consider the entire landscape around the count station from which you are picking up birds and select *the dominant habitat type that occupies the greatest amount of this area*.

Habitat classification codes:

AS = Aspen	LR = Low-elevation Riparian	RA = Rural/Agriculature
AT = Alpine Tundra	MR = Mid-elevation Riparian	SA = Sage Shrubland
CR = Cliff/Rock	MC = Mixed Conifer	SE = Semi-desert Shrubland
GR = Grassland	MS = Montane Shrubland	SB = Shore/Bank
HR = High-elevation Riparian	PJ = Pi□on-Juniper	SF = Spruce-Fir
LP = Lodgepole Pine	PP = Ponderosa Pine	WE = Wetland

Best habitat seral stage and canopy closure: Enter one-digit code of seral stage (see Appendix D for habitat-specific seral stage accounts) of habitat used in best habitat classification, followed by a one-letter code for canopy closure:

1=grass-forb stage 2=shrub-seedling stage 3=sapling-pole stage

4=mature stage 5=old growth stage

a=<40% canopy closure b=40-70% canopy closure c=>70% canopy closure

Next-best habitat classification: Enter two-letter code of habitat that NEXT best describes the habitat surrounding the point. Consider the entire landscape from which you are picking up birds and select the next-most dominant habitat type occupying the greatest amount of this area ***OR*** *select the habitat that is contributing the most birds to the point count* (if different than the Best Habitat).

Next-best habitat seral stage and canopy closure: Enter one-digit code of seral stage and one-letter code for canopy closure of habitat used in next-best habitat classification.

Primary understory classification: Enter two-letter code for primary understory vegetation type that best describes the understory within a 50-m radius of the point:

BG=bare ground	*GO=Gambel's oak*	*GF=grass/forb*
MM=mountain mahogany	*NS=not sage or willow*	*SA=sage*
SV=serviceberry	*SN=snowberry*	*WI=willow*

Primary understory percentage: Estimate the percent coverage of the primary understory type within a 50-m radius of point and enter the 1-digit code:

1=1-20% 2=21-40% 3=41-60% 4=61-80% 5=81-100%

Secondary understory classification: Enter two-letter code for secondary understory type that NEXT BEST describes the understory within a 50-m radius of the point, as described above.

Secondary understory percentage: Estimate the percent coverage of the secondary understory type within a 50-m radius of point and enter the 1-digit code, as described above.

POINT-COUNT DATA

Point #: Enter number of point (01-15) on the transect; **NOTE:** for entries of target species *between points* enter "99" (see text on Transect counts).

Species: Enter **CORRECT** four-letter code for birds (see Appendix C); PLEASE, PLEASE use correct codes, as it makes data entry and analysis easier. Species that cause particular problems for observers include: **Northern Shoveler** (NSHO, not NOSH), Ring-necked Pheasant (RINP, not RNPH), **Western Wood-Pewee** (WEWP, not WWPE), **Gray Jay** (GRAJ, not GRJA), **Tree Swallow** (TRES, not TRSW), **Bank Swallow** (BANS, not BASW), **Barn Swallow** (BARS, not BASW), **MacGillivray's Warbler** (MGWA, not MAWA), **Yellow Warbler** (YWAR, not YEWA), **Yellow-rumped Warbler** (AUWA - for Audubon's Warbler, MYWA for Myrtle's Warbler, not YRWA), **Lark Bunting** (LARB, not LABU), **Sage Sparrow** (SAGS, not SASP), **Savannah Sparrow** (SAVS, not SASP), **Lazuli Bunting** (LAZB, not LABU) and **Red-winged Blackbird** (RWBL, not RWBB).

Radial distance: Measure radial distance (estimate only when necessary) to *each* bird (that is, direct distance from point to bird), using a binocular rangefinder, in one-meter units (when estimating, **DO NOT** round off to five- or ten-meter units) -- if beyond a kilometer (1000 meters), fit number in the three spaces provided as best you can.

Bearing: *When recording low-density target species on point counts and in between points, use your declination-adjusted compass to site in the direction of the bird and record the true bearing (as opposed to magnetic) to the bird.*

How: Enter code for how each individual was **detected**: C=calling, S=singing, D=drumming, O=other aural cue; V=visual; F=flyover; K=flock

Sex: Enter code for sex: M=male, F=female, U=unknown

VERY IMPORTANT: Skip a line between entries for individual points and/or individual legs of the transect. That is, all individual birds on a particular point (or transect leg) should be bunched together on the form; then you should leave a blank line before starting entries for the next transect leg (or point).

OTHER IMPORTANT REMINDERS:

Before leaving your transect sites, don't forget to:

enter transect and page #'s at the bottom of EACH page!

record the end of transect data (time, temp, sky, wind, transect notes) IMMEDIATELY UPON COMPLETING THE TRANSECT!

go through your data sheets carefully to make sure that you have not forgotten to record any data. Your work is not done until you've reviewed your data from the morning!

provide clear and explicit directions to the access point, if you have not already done so!

Appendix B. Low-density target species by habitat.

Habitat	Low-density target species
ALL HABITATS	Turkey Vulture, ALL raptors, ALL galliforms, Band-tailed Pigeon, Greater Roadrunner, ALL owls, Common Nighthawk, ALL swifts, Belted Kingfisher, ALL woodpeckers (except N. Flicker), Olive-sided Flycatcher, Hammond's Flycatcher, Cordilleran Flycatcher, Say's Phoebe, Loggerhead Shrike, Gray Jay, Clark's Nutcracker, American Crow, ALL ravens, Tree Swallow, Northern Rough-winged Swallow, Bank Swallow, Black-capped Chickadee, Bushtit, Red-breasted Nuthatch, White-breasted Nuthatch, Brown Creeper, Rock Wren, Canyon Wren, American Dipper, Western Bluebird, Swainson's Thrush, Curve-billed Thrasher, Cedar Waxwing, MacGillivray's Warbler, Canyon Towhee, Black-throated Sparrow, Sage Sparrow, Lazuli Bunting, Pine Grosbeak, Cassin's Finch, Red Crossbill, Lesser Goldfinch, Evening Grosbeak
Alpine Tundra	White-tailed Ptarmigan, Brewer's Sparrow, Fox Sparrow, Brown-capped Rosy-Finch
Aspen	Hammond's Flycatcher, Dusky Flycatcher, Orange-crowned Warbler
Grassland	Mountain Plover, Upland Sandpiper, Long-billed Curlew, McCown's Longspur, Chestnut-collared Longspur
High-elevation Riparian	currently no others
Lodgepole Pine	currently no others
Mid-elevation Riparian	currently no others
Mixed Conifer	Orange-crowned Warbler
Montane Shrubland	Blue-gray Gnatcatcher
Pi□on-Juniper	Black-chinned Hummingbird, Gray Vireo, Pinyon Jay, Virginia's Warbler
Ponderosa Pine	Blue-gray Gnatcatcher, Grace's Warbler
Sage Shrubland	currently no others
Semidesert Shrubland	currently no others
Spruce/Fir	currently no others

Appendix C. Key to four-letter bird name codes (alphabetical by species name).

Code	Species
AMAV	American Avocet
AMBI	American Bittern
AMCO	American Coot
AMCR	American Crow
AMDI	American Dipper
AMGO	American Goldfinch
AMKE	American Kestrel
AMPI	American Pipit
AMRO	American Robin
AWPE	American White Pelican
AMWI	American Wigeon
ATFL	Ash-throated Flycatcher
BAEA	Bald Eagle
BAOR	Baltimore Oriole
BTPI	Band-tailed Pigeon
BANS	Bank Swallow
BNOW	Barn Owl
BARS	Barn Swallow
BEVI	Bell's Vireo
BEKI	Belted Kingfisher
BEWR	Bewick's Wren
BLPH	Black Phoebe
BLSW	Black Swift
BLTE	Black Tern
BBCU	Black-billed Cuckoo
BBMA	Black-billed Magpie
BCCH	Black-capped Chickadee
BCHU	Black-chinned Hummingbird
BCNH	Black-crowned Night-Heron
BHGR	Black-headed Grosbeak
BNST	Black-necked Stilt
BTYW	Black-throated Gray Warbler
BTSP	Black-throated Sparrow
BLGR	Blue Grosbeak
BGRU	Blue Grouse
BLJA	Blue Jay
BGGN	Blue-gray Gnatcatcher
BWTE	Blue-winged Teal
BOBO	Bobolink
BOOW	Boreal Owl
BRBL	Brewer's Blackbird
BRSP	Brewer's Sparrow
BTLH	Broad-tailed Hummingbird
BRCR	Brown Creeper
BRTH	Brown Thrasher
BCRF	Brown-capped Rosy-Finch
BHCO	Brown-headed Cowbird
BUOR	Bullock's Oriole
BUOW	Burrowing Owl
BUSH	Bushtit
CAGU	California Gull
CAGO	Canada Goose
CANV	Canvasback
CANT	Canyon Towhee
CANW	Canyon Wren
CAFI	Cassin's Finch
CAKI	Cassin's Kingbird
CASP	Cassin's Sparrow
CAEG	Cattle Egret
CEDW	Cedar Waxwing
CCLO	Chestnut-collared Longspur
CHRA	Chihuahuan Raven
CHSW	Chimney Swift
CHSP	Chipping Sparrow
CHUK	Chukar
CITE	Cinnamon Teal
CLGR	Clark's Grebe
CLNU	Clark's Nutcracker
CLSW	Cliff Swallow
COGR	Common Grackle
COME	Common Merganser
CONI	Common Nighthawk
COPO	Common Poorwill
CORA	Common Raven
COSN	Common Snipe
COYE	Common Yellowthroat
COHA	Cooper's Hawk
COFL	Cordilleran Flycatcher
CBTH	Curve-billed Thrasher
GHJU	Dark-eyed Junco
DICK	Dickcissel
DCCO	Double-crested Cormorant
DOWO	Downy Woodpecker
DUFL	Dusky Flycatcher
EAGR	Eared Grebe
EABL	Eastern Bluebird
EAKI	Eastern Kingbird
EAME	Eastern Meadowlark
EAPH	Eastern Phoebe
EASO	Eastern Screech-Owl
EUCD	Eurasian Collared-Dove
EUST	European Starling
EVGR	Evening Grosbeak
FEHA	Ferruginous Hawk
FISP	Field Sparrow
FLOW	Flammulated Owl
FOTE	Forster's Tern
FOSP	Fox Sparrow
FRGU	Franklin's Gull
GADW	Gadwall
GAQU	Gambel's Quail
GOEA	Golden Eagle
GCKI	Golden-crowned Kinglet
GRWA	Grace's Warbler
GRSP	Grasshopper Sparrow
GRCA	Gray Catbird
GRFL	Gray Flycatcher
GRAJ	Gray Jay
GRVI	Gray Vireo
GBHE	Great Blue Heron
GCFL	Great Crested Flycatcher
GHOW	Great Horned Owl
GTGR	Great-tailed Grackle
GRPC	Greater Prairie-Chicken
GRRO	Greater Roadrunner
GRHE	Green Heron
GTTO	Green-tailed Towhee
AGWT	Green-winged Teal
GUSG	Gunnison Sage-Grouse
HAWO	Hairy Woodpecker
HAFL	Hammond's Flycatcher
HETH	Hermit Thrush
HOGR	Horned Grebe
HOLA	Horned Lark
HOFI	House Finch
HOSP	House Sparrow
HOWR	House Wren
INBU	Indigo Bunting
JUTI	Juniper Titmouse
KILL	Killdeer
LBWO	Ladder-backed Woodpecker
LARB	Lark Bunting
LASP	Lark Sparrow
LAZB	Lazuli Bunting
LEBI	Least Bittern
LETE	Least Tern
LEGO	Lesser Goldfinch
LEPC	Lesser Prairie-Chicken
LESC	Lesser Scaup
LEWO	Lewis's Woodpecker
LISP	Lincoln's Sparrow
LOSH	Loggerhead Shrike
LBCU	Long-billed Curlew
MGWA	MacGillivray's Warbler
MALL	Mallard
MAWR	Marsh Wren
MCLO	McCown's Longspur
MIKI	Mississippi Kite
MOBL	Mountain Bluebird
MOCH	Mountain Chickadee
MOUP	Mountain Plover
MODO	Mourning Dove
NOBO	Northern Bobwhite
RSFL	Northern Flicker
NOGO	Northern Goshawk
NOHA	Northern Harrier
NOMO	Northern Mockingbird
NOPI	Northern Pintail
NOPO	Northern Pygmy-Owl
NRWS	Northern Rough-winged Swallow
NOSG	Northern Sage-Grouse
NSWO	Northern Saw-whet Owl
NSHO	Northern Shoveler
OSFL	Olive-sided Flycatcher
OCWA	Orange-crowned Warbler
OROR	Orchard Oriole
OSPR	Osprey
PEFA	Peregrine Falcon
PBGR	Pied-billed Grebe
PIGR	Pine Grosbeak
PISI	Pine Siskin
PIJA	Pinyon Jay
PLVI	Plumbeous Vireo
PRFA	Prairie Falcon
PUMA	Purple Martin
PYNU	Pygmy Nuthatch
RECR	Red Crossbill
RBWO	Red-bellied Woodpecker
RBNU	Red-breasted Nuthatch
RHWO	Red-headed Woodpecker
RNSA	Red-naped Sapsucker
RTHA	Red-tailed Hawk
RWBL	Red-winged Blackbird
REDH	Redhead
RNDU	Ring-necked Duck
RINP	Ring-necked Pheasant
RODO	Rock Dove
ROWR	Rock Wren
RCKI	Ruby-crowned Kinglet
RUDU	Ruddy Duck
RUHU	Rufous Hummingbird
RCSP	Rufous-crowned Sparrow
SAGS	Sage Sparrow
SATH	Sage Thrasher
SACR	Sandhill Crane
SAVS	Savannah Sparrow
SAPH	Say's Phoebe
SCQU	Scaled Quail
STFL	Scissor-tailed Flycatcher
SCOR	Scott's Oriole
SSHA	Sharp-shinned Hawk
STGR	Sharp-tailed Grouse
SEOW	Short-eared Owl
SNEG	Snowy Egret
SNPL	Snowy Plover
SOSP	Song Sparrow

SORA	Sora
SPSA	Spotted Sandpiper
SPTO	Spotted Towhee
STJA	Steller's Jay
SWHA	Swainson's Hawk
SWTH	Swainson's Thrush
TTWO	Three-toed Woodpecker
TOSO	Townsend's Solitaire
TRES	Tree Swallow
TUVU	Turkey Vulture
UPSA	Upland Sandpiper
VEER	Veery
VESP	Vesper Sparrow
VGSW	Violet-green Swallow
VIRA	Virginia Rail
VIWA	Virginia's Warbler
WAVI	Warbling Vireo
WEBL	Western Bluebird
WEGR	Western Grebe
WEKI	Western Kingbird
WEME	Western Meadowlark
WESO	Western Screech-Owl
WESJ	Western Scrub-Jay
WETA	Western Tanager
WEWP	Western Wood-Pewee
WBNU	White-breasted Nuthatch
MWCS	White-crowned Sparrow
WFIB	White-faced Ibis
WTPT	White-tailed Ptarmigan
WTSW	White-throated Swift
WWCR	White-winged Crossbill
WITU	Wild Turkey
WILL	Willet
WISA	Williamson's Sapsucker
WIFL	Willow Flycatcher
WIPH	Wilson's Phalarope
WIWA	Wilson's Warbler
WODU	Wood Duck
YWAR	Yellow Warbler
YBCU	Yellow-billed Cuckoo
YBCH	Yellow-breasted Chat
YHBL	Yellow-headed Blackbird
AUWA	Yellow-rumped Warbler

Appendix D. Design of riparian and Wetland transects.

Low-elevation Riparian – We will determine the number of navigable river miles below 6000 feet elevation (the approximate beginning level of changeover from low-elevation to high-elevation species of cottonwood) in Colorado. From that selection pool, we will randomly select 30 one-mile stretches of river. On the selected stretches, two-person teams (an observer and a canoer) will run the transects by canoe, utilizing true transect methodology and estimating the perpendicular (from the river) distance to each bird detected. In other respects, methodology will not differ.

Mid-elevation and High-elevation Riparian – Conduct 1000 meter (1 km) line transects, estimating the perpendicular (from the transect line) distance to each bird detected. In other respects, methodology will not differ.

Wetlands – We use line transect methodology to sample this habitat, conducting transects of 300 meters length, estimating the perpendicular (from the transect line) distance to each bird detected. In other respects, methodology will not differ.

Appendix E. Guidelines for Classifying Habitat, Seral Stage, and Canopy Closure

The following characteristics can generally define the various seral stages of the habitats listed below. However, they are intended to be used as a guide, not gospel. Variability among sites is to be expected depending on geographic location, elevation, aspect, slope, soil quality and other site characteristics. Therefore, you must still use your head when judging seral stage. All data regarding habitat should be recorded on page 1 of the field form *prior to beginning each point count*.

Estimating Canopy Closure

For all habitats (other than MG) in seral stages 2-5, canopy closure should also be assessed ***at each point count station*** using the following codes:

a = canopy closure < 40%b = canopy closure 40-70%c = canopy closure > 70%.

Canopy closure should be assessed based on the openness of the canopy for both the primary and secondary habitats selected at each point. Ex. = a mature stand of ponderosa pine with greater than 70% of sky obscured by canopy vegetation should be classified as '4c'.

Assessing Habitat and Seral Stage in Selected Habitats

Aspen (AS)

AS habitat description:
AS habitat consists of small or large forested stands dominated by quaking aspen. AS stands are generally not monotypic; other tree species that frequently occur within or adjacent to AS include, from lower to higher elevations, Ponderosa Pine, White Fir, Blue Spruce, Douglas-fir, Lodgepole Pine, Englemann Spruce, and Subalpine Fir. Some AS stands have a woody understory of a variety of species, depending upon location, elevation, and other factors. These understory species can include Common Juniper, Mountain Mahogany, Big Sage, Snowberry, Serviceberry, among others. Other stands have only herbaceous under-stories.

AS seral stage assessment:

1 = Grass-Forb stage: Grasses and forbs dominate; aspen suckers/saplings are absent.

2 = Shrub-Seedling stage: Suckers/saplings are present, up to 2 inches dbh and 4 m in height. Stem density can vary from 5,000 to 40,000 stems per acre.

3 = Sapling-Pole stage: Saplings between 2 and 8 inches dbh and up to 6-13 m in height on good sites; on poorer sites trees may never reach 8 inches dbh and may be shorter than 6 m, with crooked and twisted boles.

4 = Mature stage: Trees > 8 inches dbh; on better sites, trees between 16-24 inches dbh and 28-33 m in height. Typically, there is a high density of grass, forbs and shrubs in the understory. Snags are also generally common in this stage.

5 = Old-Growth stage: Large diameter trees and many snags are present, as are diseased trees and downed material. Snags may occur in large groups in this stage.

Ponderosa Pine (PP)

Habitat description:

PP habitat is forest dominated by, amazingly, Ponderosa Pine, often in pure stands, but there are often admixtures of Aspen, White Fir, Douglas-fir, and/or Blue Spruce and the habitat can intergrade at its upper elevational level with Lodgepole Pine. The habitat occurs primarily between 5500' and about 8500', though it can occur at slightly higher elevations in some places. In some places, particularly in South Park, Ponderosa Pine and Limber Pine co-occur. However, habitats designated PP should consist primarily of Ponderosa Pine; habitats with any significant admixture (>20%) of some other conifer should be called Mixed Conifer (MC). The habitat often has a well-developed woody under-story, though historic burn frequencies kept most stands fairly open with large, widely-spaced trees. In areas where fire has been excluded, a significant Gambel Oak understory often develops and these areas can host large numbers of shrub-dependent species, e.g., Green-tailed and Spotted towhees and Dusky Flycatcher.

PP seral stage assessment:

1 = Grass-Forb stage: Grasses and forbs dominate; pine seedlings and shrubs scarce or absent. This stage usually results from fire and/or logging.

2 = Shrub-Seedling stage: Small pine saplings, <=1 inch dbh, and a variety of woody shrubs small deciduous trees are present, as well as herbs. Litter and downed material may exist.

3 = Sapling-Pole stage: Trees 1-8 inches dbh, 3-17 m in height; age of stand 6-50 yrs old. Stands in this stage can be quite dense, normally exceeding 70% canopy closure, and are typically even aged. Some small diameter snags may be present.

4 = Mature stage: Avg. dbh of trees >8 inches. *Stand may be multi-layered*, and snags suitable in size for most cavity-nesting birds should be present. Oak layer, if present, is usually well developed.

5 = Old-Growth stage: Avg. dbh of dominant trees >8 inches, with some trees between 30 to 60 inches; *stand typically of uneven age, woody understory is extensive and well-developed*; canopy and stand structure generally open; numerous large snags, dying trees, and downfall present.

Spruce-Fir (SF)

Habitat description:

SF habitat refers to areas dominated by Englemann Spruce and Subalpine Fir. This

habitat typically occurs at elevations above 8000'. This habitat often mixes with

Lodgepole Pine (LP), so be careful about the particular tree species present. These stands can be monotypic, but usually have admixtures of Aspen (AS).

SF seral stage assessment:

1 = Grass-Forb stage: Primarily herbaceous plants; no trees or saplings; near complete absence of downed litter or snags.

2 = Shrub-Seedling stage: Spruce saplings up to 1 inch dbh are present.

3 = Sapling-Pole stage: Stems 1-7 inches dbh, and; snags and downfall present.

4 = Mature stage: Avg. dbh of trees >8 inches. *Stand may be multi-layered*, and snags suitable in size for most cavity-nesting birds should be present.

5 = Old-Growth stage: Avg dbh of dominant trees > 22 inches; *forest is typically multi-layered*, with trees of varying age/size, significant amounts of accumulated downfall and numerous, randomly distributed snags. Grasses and forbs are relatively scarce, but *epiphytic vegetation (mosses & lichens) is prevalent*.